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ABSTRACT

The "Technically Speaking" columns from several isues of "The Source" magazine are reprinted. The columns were written by Gregg Vanderheiden, Peter Borden, Roger Smith, Jane Berliss, and Charles Lee. Titles of the columns included are: "Technological Advances: A Boon or a Barrier to Persons with Disabilities?"; "Rehabilitation Technology--Hunting for Information"; "Augmentative Communication: Other Ways of Being Heard"; "Environmental Controls: Using Technology to Control Technology"; "Future Directions in Access: Disability and the Electronic Revolution" (second in a series); "Accessible Workstations: An Often Neglected Necessity"; "Hearing the Computer Screen: Questions and Answers on Voice Output"; "A Little Light Reading" (a list of periodicals on assistive technology); and "Conferences" (containing information on two conferences on developments in rehabilitation). (JDD)

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Technically Speaking

Columns from the monthly magazine *The Source*, 1987-88

Trace Center

Trace R & D Center
on Communication, Control
and Computer Access
for Handicapped Individuals

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Technically Speaking

Gregg Vanderheiden, Ph.D.

Trace R & D Center
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Technological Advances: A Boon or a Barrier to Persons With Disabilities?

This is the first of a continuing series of observations, summaries, and updates on the state of the art in the use of technologies by persons with disabilities.

Although it was first thought that the advent of technology would automatically result in a society which was easier for people with disabilties to function in, the process is proving to be far from automatic. Technology holds great potential for facilitating the performance and integration of individuals who have disabilities. It is now clear, however, that such potetials will only be realized if a tremendous amount of effort on a broad range of fronts is carried out to help inform and guide the development of the new technologies. Without these efforts, the nature of technological advancements is to create technologies which are more and more closely matched to the capabilities of the fully able-bodied users (alone). Although this can increase ease of use and productivity for the fully able portion of the population, it can hamper and even preclude use of the same technologies by individuals who have an impairment in one or more of their abilities.

For example, the use of mice and other fine-resolution pointing devices has greatly decreased the training time and increased the productivity of individuals using computers for some tasks. It has at the same time, however decreased or prevented the use of these computer systems by individuals without fine motor control. Similarly, the advent of higher resolution displays has increased the ability to create and edit formatted documents, but has decreased or barred the use of these new systems by individuals who are blind. The advent of speech control for computers and other devices is heralded as a future advance in facilitating control of devices, and even has particular advantages for individuals with some types of disabilites. However, individuals with speech impairments due to physical impairment or deafness will find these same systems less accessible or inaccessible.

The use of the mouse has decreased or prevented use of computer systems by individuals without fine motor control

If these devices were optional or for convenience, any inability to effectively use them would be unfortunate but not catastrophic. The fact that an individual with an impairment would have a more difficult time in doing some things is a fact of life. The impact of this problem, however, lies in the fact that as employment settings, educational settings, and socielty in general become more technically based, the ability to use these technical systems will not be optional. Individuals who cannot operate the particular computer system and software which is used by a firm throughout its office will not be able to work in that office. Schools which inc orporate the use of computers as part of their educational process will be "inaccessible" to students who are unable to use these computers. These technology-based systems are not just confined to the workplace and educational setting. More and more, electronic technologies and systems are being incorporated throughout our lives: in banking, shopping, and information services.

At the present time, these access dangers are real, but not widespread. Computers are only begining to be effectively used in the classroom. The potential for using computers as part of the instructional process, however, is clear, and it will not be very many years before the computer joins the pencil, paper, and textbook as integral tools in the educational process.

In industry, computers have much more widespread use. Although there are still many office jobs which are not computer-based, computers are rapidly making inroads. This is particularly true in the information and middle-management areas. Unfortunately, these are also the types of jobs which are often best suited to individuals with impairments that limit their capabilities for manual labor. Basically, any "thinking" job is an information-handling job.

The incorporation of these technologies in the community is perhaps farthest behind. Although we have automatic teller machines, electronic building directories and card catalogs, most of daily routine is relatively untouched by technology at this point. The trends, however, are clearly there, and advancements are moving rapidly. For example, greater use is being made of electronic information and shopping systems in daily life to increase choice and decrease costs. Even Sears has signed up with a major telemarketing effort to create an electronic Sears catalog.

The technological advances described above do not have to be barriers for the disabled. If designed in such a way that they are accessible and usable by individuals with various impairments, these advancements can hold great promise for enabling individuals with impairments to participate side-by-side with able-bodied colleagues. For example, electronic information systems in industry can greatly facilitate information manipulation by movement-impaired indivdauls and access to information by sensory-impaired individuals. Similar gains can be found in educational systems, where physics or chemistry experiments which previously were outside the capability range for severely motor-impaired individuals can be carried out through simulation (a powerful and much less expensive educational approach being explored in science education). In addition, the ability to bank, shop, and secure services and information electroniacally can decrease the amount of "maintenance time" required by disabled individuals in daily living, freeing more time for productive activity or personal creativity. In addition, these "accessibility" features need not interfere with and usually facilitate use of these devices by the fully able-bodied users by increasing speed of operation and decreasing effort and fatigue.

For More Information on Computers and the Disabled: Trace R&D Center S-151 Waisman Center 1500 Highland Avenue Madison, Wi 53705 608/263-5408, Closing the Gap 107 1/2 North 8th street Henderson, MN 56044 612/248-3294, Center for special education Technology Council for Exceptional Childred (CEC) 1920 Association Drive Reston, VA 22091 703/620-3660 800/345-TECH, Sloane Report P.O. Box 561689 Miami, Fl 33256 305/274-3501

Technically Speaking

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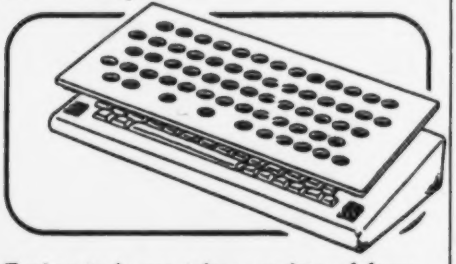
Computer "Jar Openers"- Simple Strategies for Accessing Personal Computers

The growth in the use of personal computers has led to the development of many special adaptations for the people with disabilities. Some of these are fairly sophisticated-such as optical headpointer keyboards and morse code input-but many disabled computer users won't need such extensive adaptations. There are a number of simple adaptations that may be sufficient to provide access. Like those rubber pads used to open jars, these simple adaptations provide that extra boost a person might need to change a physical task (operating the keyboard or handling disks) from a difficult, frustrating experience to one that can be accomplished with relative ease.

If you are trying to find the right adaptations for a computer, it's best to find a professional familiar with their selection and use. The descriptions below are meant to provide and overview of computer "jar openers," to give you a general idea of what's available and how it works. Some of the products were especially designed for disabled computer users; others were designed for more general uses.

For the Keyboard



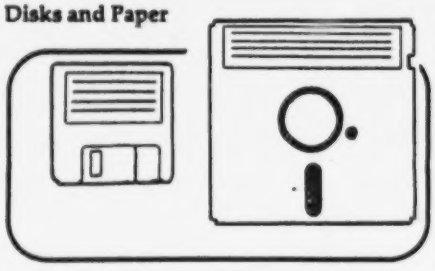
Typing tools can take a variety of forms. Simple pencil grips and hand splints can enable a person to hold a typing stick (such as a pencil) for pressing computer keys. In addition to their other uses, head wands and mouthsticks can serve as typing tools.

Keyguards are plastic panels that fit over the existing keyboard and have holes drilled in them, one hole for each key on the keyboard. Keyguards can help prevent accidental key presses, and can also provide the user with a surface to rest their hand or typing tool while pressing a key or moving to another key.

Some keyguards also have key latches, which allow the single finger typist to lock down keys (such as SHIFT) which normally have to be pressed at the same time as another key. On some computers this latching can be accomplished using special software instead. Moisture guards are clear flexible coverings that keep liquids such as saliva from getting on or between the keys.

Most computer keyboards have an "auto-repeat" feature: when a key is held down for a certain length of time, its letter begins to repeat. If you keep pressing "A" and getting "AAAAA" you might want an auto-repeat modifier. Some of these modifiers allow you to set the delay time before the auto-repeat comes on and to set the auto-repeat rate itself. Others simply shut off the auto-repeat entirely.

Disks and Paper



There are a number of available adaptations for handling paper and computer disks. For instance, small handles can be put on disks so that they can be handled with a mouthstick. Disk loaders are trays that mount in front of the disk drive. The user places the disk flat on the tray and then slides it into the slot in the drive.

Hard disks are standard computer equipment. A hard disk is mounted permantently in the computer, and holds much larger amounts of data than a "floppy" disk. The user can store all of their programs and files on the hard disk, reducing the need to insert floppy disks into the computer.

The traditional 5-1/4" floppy disk is currently being ousted by a new design, a 3-1/2" disk with a hard plastic case. The rigid case makes it harder to damage the disk inside. These disks also do not require the user to push the disk all the way into the drive or to close a latch after the disk is in. They can be ejected (like a cassette tape) by pressing a button or by typing a command on the keyboard.

For handling paper, there are special paper loaders that allow a sheet of paper to be rested on a tray before being inserted into the printer. There are also printers that come with auto-feed mechanisms for paper.

Faster Typing Rates

One of the problems encountered by many physically disabled computer users (and able-bodied ones as well) is a slow rate of typing. One type of product that can help is an abbreviation expansion (or "macro") program. This software runs in the background while the user is running another program, and allows the user to type a short set of characters (the abbreviation) and produce a longer set of characters (the expansion). With some of these programs the user is free to create their own list of abbreviations and expansions, and to use almost any combination of characters. Some abbreviation expansion programs have been designed especially for people with disabilities; others were designed for general use.

Hopefully this overview of computer "jar openers" has made you more aware of the simple ways computers can be made easier to use. Future installments of this column will explore some of the more sophisticated types of adaptations designed for individuals with more severe disabilities or impairments.

Some of the makers of adaptations described in this column are:

Adaptive Peripherals, Inc., 4529 Bagley Avenue North
Seattle, WA 98103, (206) 633-2610

ComputAbility Corporation
A Division of Preston, 101 Route 46 East, Pine Brook, NJ 07058, (201) 882-0171

Designing Aids for Disabled Adults
1024 Dupont Street
Toronto, ON M6H 2A2, CANADA
(416) 533-4494

Developmental Equipment
981 Winnetka Terrace
Lake Zurich, IL 60047, (312) 438-3476

Extensions for Independence
757 Emory Street, Suite 514, Imperial Beach, CA 92032
(619) 426-8054

Prentke Romich Company
1022 Heyl Road, Wooster, OH 44691
(216) 262-1984

TASH, Inc., 70 Gibson Drive, Unit 12
Markham, ON L3R 4C2, CANADA, (416) 475-2212

If you have questions about these or other adaptations, contact:

Trace Center, University of Wisconsin - Madison, S-151 Waisman Center, 1500 Highland Avenue, Madison WI 53705, (608) 262-6966

Technically Speaking

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Rehabilitation Technology- Hunting For Information

Someone once said (I think it was Mrs. Schmidt, my fourth-grade teacher) that the next best thing to knowing something is knowing how to find it out. In the case of technology for rehabilitation, so much has been developed and become available in recent years that no one, not even a professional who works with technological aids, can keep track of it all.

For those times when the "top of your head" fails you as an information source (as mine so often does), it's important to know where to turn to find out what you want to know. A lot of informational resources are out there, but how do you know where to look?

The Right Questions

The first step is knowing what it is you want to know — in other words, finding the right questions to ask. What do you want to accomplish that you think technology could help you with? You need not have a complete answer to this question at first: the more you learn, the more you will be able to define what technology can help you do.

Getting Started

You may begin your inquiry with a clue in the form of something a friend told you, or something you read about. You heard that there are computers that can be operated by voice command, for example. How can you follow up on this clue? How do you find out who makes these computers, how they operate, and whether they could be of particular use to you?

Some possible information sources may occur to you immediately. The public library, for instance, will have computer publications. A publication's annual index should provide you with a list of articles on voice control of computers. A local computer dealer may be familiar with the technology as well.

If you start by creating a list of potential information sources, you may soon find that you have more than you need, rather than less. But if you only have a couple of contacts, don't despair: just start with what you have. At the end of this article is a list of some possible sources to consult in order to begin your search.

The Search

The hard part begins when you start inquiring. Chances are good that you won't find what you want or need right away, and the process can quickly become frustrating.

Don't give up. Concentrate on trying to finding a good source of information on your chosen topic. If one group or agency can't tell you what you want to know, ask them if they know of someone else who might. Sound them out and see if you think they are giving you solid information or just groping because they feel they should give you something.

Be willing to revise your idea of what you are looking for. On closer examination, you may find that a voice controlled computer is not the best way of meeting your needs. In the process of investigating voice control, however, you may have come across information that leads you to another possible solution.

Talking to the Pros

Even if you think that your situation is a simple one, you can probably benefit from the advice or services of a rehabilitation professional. Someone who is familiar with the selection, fitting, etc. of a particular type of product may be able to save you time and effort.

As with information sources, be sure to sound out the professional person and see if they have the necessary knowledge of the technology you are interested in to be able to help you. Fill them in on what you have found out so far. Even if they can't help you directly, they may be able to provide you with more information, or lead you to someone who does provide services that you need.

Where to Start

Where you start depends upon what you want to know and what your resources for search are (some information services charge, for instance). Here are some suggestions:

Local, State and Federal Rehab Agencies: Because they need them in their jobs, officers of these agencies are liable to have information files on available technology.

Independent Living Centers: These may also have technology information files, as well as experience in helping people use technology to achieve greater independence.

Books and Other Publications: Probably the most valuable source to consult in starting your search is the Technology for Independent Living Sourcebook. This single volume contains summary information on each area of rehab technology (mobility, communication, education, etc.), plus a multitude of addresses of people and organizations to contact. You can check your public library or obtain a copy from: the Association for the Advancement of Rehabilitation Technology, 1101 Connecticut Avenue, Suite 700, Washington, DC 20036).

Manufacturer's catalogs can serve as source of information, and there are also directories of

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Customized Vans For The Disabled

At DMC trained salespeople give the customer an education on how to buy a custom van. The customer is first shown how to correctly buy the van chassis. "Many times a customer will be sold an improperly equipped chassis," Jeff Seitz, Sales Representative for DMC said in an interview. The result is a waste of money by the customer of sometimes as much as $500.00 or more. We avoid this by showing the customer exactly how the bare van chassis should be ordered so that it is compatable with the customers individual conversion requirements. This is easily done at DMC because we always have all makes of chassis in stock to physicaly show the customer what he should have and why.

"Educating the customer on the custom conversion is our most important job," David Mock, owner of DMC said. We know that most people want a good quality conversion. We sell product not price, and by educating the customer, we justify our price. We show the customer exactly how we build the vans and compare our method

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assistive products, such as the Rehab/Education Resource-Book Series (available from the Trace Center, S-151 Waisman Center, 1500 Highland Avenue, Madison, WI 53705) and a series of "Directories of Assistive Device Sources" (published by Lifeboat Press, Marina Del Rey, California).

On-Line Databases: If you have access to a computer and a modem, you can check out national databases that deal with rehabilitation technology. One such database is ABLEDATA, which lists all available disability-related consumer products. (It is available through the BRS database service; contact NARIC, 4407 Eighth Street NE, Washington, DC 20017.)

Many states are also establishing statewide information and referral networks listing available services in the state for people with disabilities, including technological services. The average citizen contacts an agency which in turn looks up the information.

Technically Speaking

Peter Borden
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Augmentative Communication: Other Ways Of Being Heard

Some people with severe physical disabilities that affect muscle control will also have difficulty with speech, since speech involves the use of a number of muscles. Some conditions that can cause this type of impairment are: cerebral palsy, muscular dystrophy, ALS (Lou Gehrig's Disease), spinal cord injury, and stroke. If a person has severe enough problems with speech, they may need some form of augmentative communication to use in conversation and other forms of interaction. They may also need some alternative way of writing.

The term augmentative communication refers to some way of communicating that does not require speech. A person who uses augmentative communication may have some speech, but will also use some special technique—such as gestures or pointing to words on a board—to get their ideas across.

Developing a System

Because selecting the right communication system can be a complex process, it is best to work directly with a professional team trained in augmentative communication techniques. If you or someone you know could use professional services, try contacting hospitals, rehabilitation agencies, nonprofit disability organizations, local school districts, or state and local information and referral agencies to determine who in your area is the best trained and most experienced in augmentative communication.

If there is no resource in your immediate area, you should consider having a formal evaluation (the first step in developing the communication system) done at a regional center that specializes in augmentative communication--even if this involves travelling some distance. Such a regional center is likely to have a greater number and variety of devices to see and try.

An evalution can take anywhere from a couple of hours to a day or two. The clinical team will determine the most appropriate type of communication system for the person, and the best way for the person to control the system. Rate of communication is an important consideration, since the speed at which a person can communicate using one type of system can be radically different from their speed with another type.

Once a system is chosen, there is still a lot of work to do: the person must learn how to use the system, vocabulary must be selected, and custom alterations may have to be made. Some people, especially youngsters, may reqire training in basic communication skills as well.

Types of Communication Aids

There are two basic kinds of systems: non-electronic and electronic.

Non-electronic communication systems take a variety of forms. Communication boards have letters, words or pictures displayed on them. The user points to choices in order to form messages. Pointing may be done with the hand, with a head-mounted pointer, with a lightbeam pointer, or by other means. Eye-gaze boards allow the user to select words, etc. by looking at locations on the board. Since large communication boards are best suited to people with wheelchairs to mount them on, people who are ambulatory (walking) sometimes use communication books, which are more portable.

Electronic communication systems range from simple rotary scanners, which have a clock-like dial showing words or pictures, to computerized aids that provide electronic synthesized speech. Computerized aids have undergone a great deal of development in the past five years, and generally offer some combination of a visual display, a printer, and a synthesized voice for conveying messages.

A variety of input devices (controls) are available, so that users with different physical capabilities can create messages. Keyboards, optical pointers (a device like a small flashlight mounted on the head), joysticks and special switches can all be used to control certain communication aids. Almost any voluntary muscle movement—even the blinking of an eye—can be used to control some communication aid. Selecting and positioning the control is also an important part of the evaluation process.

Writing

Since handwriting can be difficult or impossible for a person with a physical disability, some way of typing is desirable. A number of options are available, including portable typewriters, portable memo writers, portable computers, and stationary computers. Many models of electronic communication aids also offer printed output.

Drawing is also an activity that a person with a physical disability may need an alternative means to accomplish. Access to a computer can provide the chance to use graphic art and drawing programs.

Learning More

You may also want to invest some time in learning about the various techniques and approaches yourself. Some newsletters of interest are:

Communication Outlook
International Society for Augmentative and Alternative Communication
P.O. Box 1762, Station R
Toronto, Ontario M4G 4A3
CANADA

Augmentative Communication News.
One Surf Way, Suite 215
Monterey, CA 93940

For general introductory information on the various aids and techniques, you might want to look at the book Augmentative Communication: an Introduction (edited by Sarah Blackstone, available from the American Speech-Language and Hearing Association or the Trace Center).

American Speech-Language and Hearing Association
10801 Rockville Pike
Rockville, MD 20852; (301) 897-5700

Trace Research and Development Center
S-151 Waisman Center
1500 Highland Avenue
Madison, WI 53705
(608) 262-6966

The Trace Center also distributes reprinted articles on communication topics, and produces a directory listing all of the existing commercially available aids on the market.

Clinical and technological advances in augmentative communication over the past 15 years have been substantial, and public awareness of the needs of non-speaking people is also increasing. As technology advances and services expand, more citizens will have a way of making themselves heard—in education, in employment, in self-advocacy, and in public and private life.

Technically Speaking

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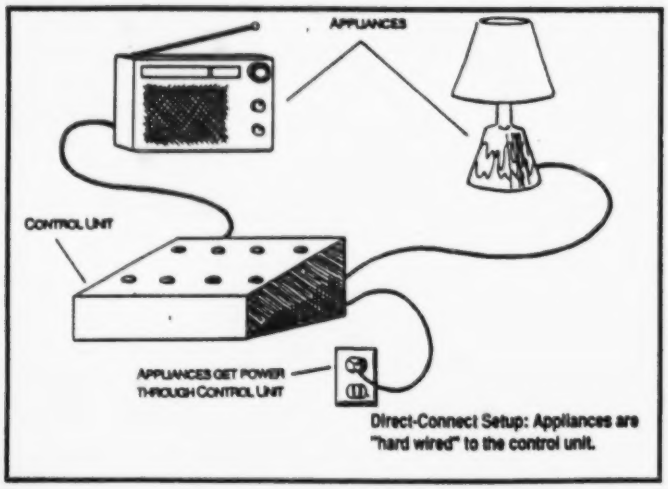
Environmental Controls Using Technology To Control Technology

The abundance of electrical appliances in our lives does a lot to make them easier. But these benefits cannot be realized by people whose disabilities make it difficult or impossible for them to operate these technological conveniences.

The location of a light switch, the pressure needed to flip a TV channel selector, the need to move quickly enough to answer the door - all of these are examples of environmental access obstacles that can be eliminated with the right application of available technology.



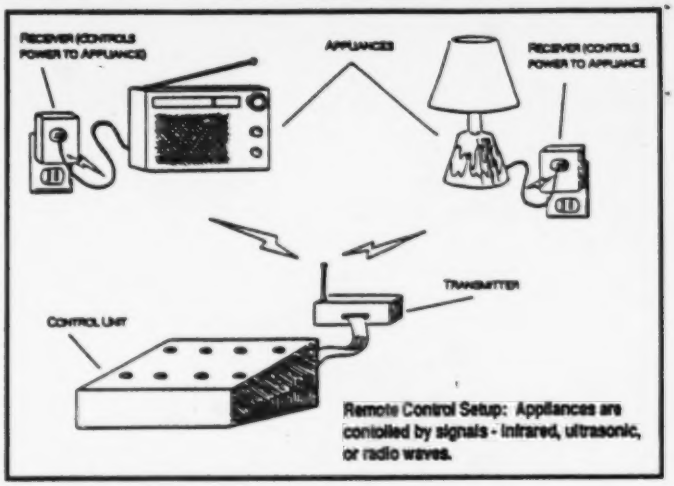
Direct-Connect Setup: Appliances are "hard wired" to the control unit.

Although there are many technically sophisticated products designed for people with disabilities, it's important not to overlook simple solutions, or ones available in the general marketplace. An ordinary TV remote control, for instance, might be all a person needs to operate their TV. The type of lamp that turns on whenever the base is touched might be easier to use than a lamp that has a twist switch located next to the bulb. An apartment might already have an intercom and door lock release installed. Simple adaptations like reachers, grabbers, headsticks or mouthsticks can assist in operating appliances as well.

When a simple solution is not readily available, however, you can turn to special adaptations. No matter what type of physical impairments a person has, they can still be provided with the means of controlling electrical devices in their home or workplace.

Direct and Remote

There are two basic forms of environmental control: direct and remote. In a direct system, the appliances to be controlled are plugged directly into the user's control unit. In remote systems, the user's control unit acts as a transmitter, broadcasting to remote receivers. The receivers are



Remote Control Setup: Appliances are controlled by signals - infrared, ultrasonic, or radio waves.

directly connected to the appliances to be controlled.

In some cases direct connection may be fine, but it's obvious that remote control can be quite a convenience. A number of appliances can be controlled from one spot, without the need to string wires from the control unit to the appliances wherever they are located.

Remote environmental control systems differ in the ways they transmit: some broadcast radio waves; some emit ultrasonic sounds; some send invisible infrared light beams. There are systems that broadcast their control signal through the household wiring, so that appliances anywhere in the house can be operated from one location.

Getting Control

There are also a number of ways the user can access the control unit. The most direct method is pushbuttons. One button corresponds to each thing you want to control: one button for each light to be turned on or off, one for each TV channel to select, one to unlock the door.

There are two possible problems with this one-to-one arrangement. First, you can end up with too many pushbuttons to realistically put on a control panel. This problem can be solved by having *channels* of control: the user first selects a channel, then the device to be controlled on that channel. In this way a panel of eight pushbuttons can control 16, 24, 32 or more appliances.

The second problem with pushbuttons is the fact that they aren't physically accessible to many people who need environmental controls. The most common alternatives to pushbuttons are special switches. There are switches that can be activated by almost any body movement—eye blink, sipping and puffing, turning the head, biting, tongue movements, etc. As a result, special switches allow people with a wide range of physical capabilities to use an environmental control.

An environmental control can be operated with just one or two switches, using a process called *scanning*. Each appliance is indicated by a small light on a panel. The lights light up in sequence, and the person hits their switch when the desired appliance is indicated.

Some systems have two switches and use step scanning: you hit the first switch to move from one appliance to the next, and the second switch to turn things on or off.

EC with your PC

One of the most exciting developments in recent years is the entry of computers into environmental control. Today there are software programs for personal computers which can control appliances throughout the house.

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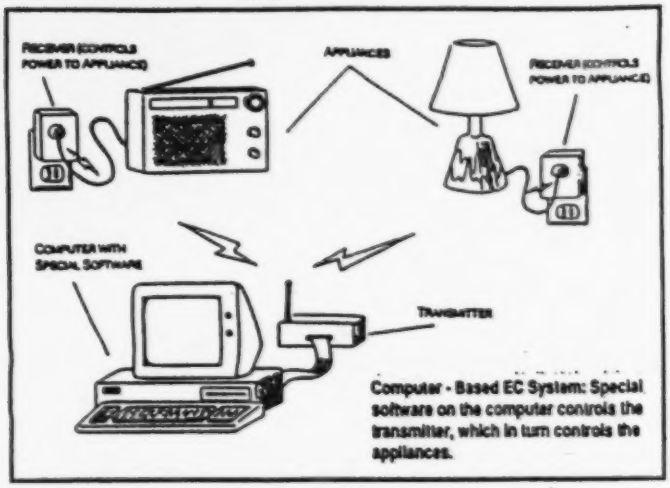

Computer - Based EC System: Special software on the computer controls the transmitter, which in turn controls the appliances.

The computer can increase the flexibility of an environmental control system by increasing the number of appliances without increasing the size of the control panel, by providing status information on appliances not visible, and by showing graphical representations of rooms and the appliances in them.

A computer can also open up access possibilities. Since special keyboards, switches, lightbeam pointers, and even voice can be used to control a computer, they can also be used to operate an environmental control system.

In the future, home automation may become more popular, increasing the sophistication and reducing the price of environmental controls. (We've already seen this happen with TV remote controls.) Although funding and technical support can pose problems for many people, the technology exists today for an automated home, operable by people with virtually any level of physical ability.

For more information resources on the topic of environmental controls, contact: Trace R & D Center, 1500 Highland Avenue, Madison, WI 53705 or call (608) 262-6966

Technically Speaking

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Future Directions in Access:
Disability and the Electronic Revolution

This column is the first in a series about how the advances in technology in our society—particularly in electronic technology—affect the lives of people with disabilities. This first installment discusses the types of technologies which are developing and need to be addressed.

Everywhere we look, changes in electronic technology are changing our daily lives. It is now possible to shop, bank, or read an encyclopedia, all through electronic devices—in some cases without leaving your home.

At first these developments seem as if they provide unprecedented opportunities for many people with disabilities. But just as a shopping mall needs to provide elevators and curbcuts, an electronic shopping service needs to guarantee that its terminals are accessible to people with disabilities.

In the context of electronic devices, the term "access" means more than just architectural access. People must not only be able to get to an automatic teller machine; they must be able to use it. The needs of people with disabilities must be integrated into the design of these electronic devices.

An Open Door to Computers

Personal computers are spreading rapidly through the workplace and have also penetrated the home and school environments, making them perhaps the most important electronic devices to guarantee access to. Many special devices have been developed so that people with a variety of disabilities can use computers. But as the computer marketplace advances, important issues must be addressed so that unforeseen roadblocks do not appear later. For instance:

- Simple modifications can be incorporated into the computer's design, such as easily reachable power switches or tactile cues for visually impaired users.

- Some computer users with physical impairments need to use special input devices designed for them, instead of the standard input devices (such as keyboards and "mice"). Computers need to be designed so that these special input devices can be successfully connected and used.

- Many visually impaired computer users need need an alternative to the standard computer screen—such as braille or electronic synthesized voice. This doesn't mean that every computer must provide braille or voice, only that such an option should be possible. The design of the computer should not close off these access routes.

Other Electronic Devices

Because personal computers have become so prevalent in work and education settings, and because they are valuable tools to many people with disabilities, it is crucial to continue to assure their accessibility. But PC's aren't the only electronic devices proliferating in our lives. We also need to deal with:

- electronic office equipment
- environmental controls
- electronic information systems
- telecommunication devices
- electronic shopping systems
- electronic directories
- emergency systems and devices
- telebanking systems

Many of these systems are still in the "emerging technology" stage. Both rapid and careful planning are needed in order to ensure that they advance along routes which are accessible or can be made accessible to people with disabilities.

These systems differ from personal computers in that they are "dedicated" to one function, and thus are less easy to customize. A microprocessor (computer) is built directly into a device such as an automated teller machine. This computer, along with the input device (keyboard) and output devices (screen and printer) is designed specifically for the functions of the teller machine. A personal computer, on the other hand, allows the user to alter its operation in many ways using special hardware and software. The adaptations that have been developed for personal computers cannot simply be "patched" on to a system such as an automated teller.

Furthermore, public devices such as teller machines require that the special needs of a wide variety of users be accommodated. A personal computer, with just one or a few people using it, is often easier to make accessible because it is easier to predict what the users' needs will be.

Despite the difficulties in adapting public electronic devices, the challenge must be met. There are a variety of possibilities, requiring more or less research or initiative. Some are simple: placing cash machines, public library information terminals and so forth at a height accessible to people using wheelchairs; making keys easier to push and letters and numbers larger; providing brailled keys and operating instructions.

Other alternatives are more complex. Public terminals such as library card catalogues, for instance, could be equipped to accept special input devices, and to convey all information both visually and in electronic voice.

Public information systems could also be designed so that people with computers at home can retrieve information over the telephone using their computer. This option already exists for many information systems, and presents advantages to citizens with or without disabilities. Imagine being able to find out the name, subject , and title of a book—as well as whether or not it's currently checked out—before even going to the library.

What Can Be Done

Legislation: The U.S. Congress has taken an important step. In the 1986 amendments to the Rehab Act of 1973, the federal government mandated the establishment of "guidelines for electronic equipment accessibility for Federal procurement of electronic equipment." The guidelines are being developed by the General Services Administration in consultation with researches and industry representatives.

Industry: The computer industry has shown a strong interest in accessibility issues for some time now. Cooperative efforts are underway to bring together the ideas of industry, researchers and consumers. These efforts have already resulted in an increased understanding of electronic access questions among both designers and executive decision makers.

Standards: Establishing electronic interface standards for special input and output devices makes it easier for the makers of "standard" devices (such as computers) to anticipate these special devices in their designs.

•see TECHNICALLY SPEAKING on page 20

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Research: In order to assure that the specific needs of people with disabilities are being met, more research is needed into a variety of issues. How can visual information be presented to people with visual impairments in a useful auditory form? How can people with motor difficulties increase their typing rates? What are effective ways to present information to people with cognitive impairments?

Awareness: As more people become aware of the benefits of electronic technology and the necessity of making it available to everyone, it will seem more natural to consider the needs of people with disabilities in designing new systems. The Industry-government initiatives mentioned before have gone a long way toward increasing awareness. The reference to purchasing guidelines in the amendments to the Rehab Act has also provided publicity for the electronic access issue.

Local action: Individuals can get involved in their own communities. Is the card catalog at your public library accessible? Does your financial institution provide you with banking services you can use? Are computers in your workplace accessible to you or your disabled colleagues? The technological answers to some of these questions may be in the future, but the time to start asking the questions is now.

Information: If you want to know more about how computers and other electronic equipment can be made more accessible, contact:

Task Force, Industry-Government Initiative on Computer Accessibility
c/o Trace R & D Center
S-151 Waisman Center
University of Wisconsin-Madison
Madison, WI 53705
(608) 262-6966

Technically Speaking

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Future Directions in Access: Disability and the Electronic Revolution

This column is the second in a series about the advances in technology in our society—particularly in electronic technology—affect the lives of people with disabilities. The installment discusses the environments in which new electronic technologies are becoming prevalent.

Our world is commonly thought of as divided into three "environments:" work, education and daily or independent living. Although these three environments have different characteristics, they are interrelated: most skills necessary for independent living are also required on the job, and education generally must precede employment.

A primary goal is to allow people with disabilities to secure competitive employment. In order to accept a job, however, individuals must be able to afford to live on their income, since by accepting a job they may disqualify themselves from government support. Individuals who are not able to live independently and who must rely upon expensive support structures and attendants cannot afford to accept a job, especially at entry wage level.

Because the three environments are so dependent on each other, attention to access in all environments is important. Even if one were only interested in advancing the employability of individuals with disabilities, and ignored the increases in quality of life and decreases in public support costs which result from enabling individuals to function more independently, one would still have to acknowledge that the accessibility of education and daily living environments affects the accessibility of employment.

Work Environment

It has frequently been pointed out that America's economy has shifted strongly in the direction of information-related business, with a resultant increase in the percentage of information-related occupations. In addition, the increase in computers and other electronic office equipment has given electronic devices an increased role in many jobs that are not specifically "information" occupations.

For workers with disabilities perhaps the most visible need in the work environment is access to computer systems. This need includes not only micro computers (personal computers), but also mainframe computers with individual access terminals, dedicated workstation computers (single-user), and multi-user or shared computers.

The technology exists to make many current computer systems accessible. Special keyboards for people with physical impairments, synthesized voice or electronic braille for people with visual impairments—these are just a few of the special access products that have been developed.

The technology exists to make many current computer systems accessible. Special keyboards for people with physical impairments, synthesized voice or electronic braille for people with visual impairments—these are just a few of the special access products that have been developed.

However, just because the adaptive technology exists does not mean that it can be applied easily and immediately. Further research and development are required in order to assure access to new computer models that appear on the marketplace, to enhance the accessibility of models already existing, and to investigate access strategies for large mainframe computer systems and networks.

In addition, there are other electronic devices or systems in the workplace besides computers to which a worker must have access. For example, telecommunication systems used to be restricted to a simple telephone. These are now being replaced by more sophisticated devices that can better be thought of as telecommunication terminals. These perform more functions, require a greater variety of user controls, and communicate with more types of communication hardware.

Information of all types is also rapidly being converted into electronic form. Reference manuals, documents, rules, procedures and other information can be more easily updated, disseminated and accessed in electronic form. The accessibility of this information and these information systems is therefore of growing importance and concern. Other systems, such as building, room or terminal security devices may be inoperable by individuals with certain disabilities, barring them from access to these environments or devices.

Educational Environment

Computers are being incorporated increasingly into educational programs to augment traditional teaching techniques, making them a top priority in assuring electronic access in education. A second area of access importance is electronic reference systems. Already libraries are converting to electronic card catalogues. In the process they are incorporating additional search, reference, and cross-reference capabilities. This trend is expected to continue, with electronic encyclopedias, scientific references, and even literature systems to follow. Again, these systems must be accessible.

Finally, a perhaps unexpected need is access to special education software. Although this software is specifically designed for individuals with disabilities, it is usually designed to address only a single area of disability. Almost all of the software designed for people with learning disabilities, for example, presumes that the individual has good vision and hearing, or has no physical impairment. Programs for the visually impaired assume no physical disability, and programs for the physically impaired often assume no visual impairment. Since many individuals have at least impairments in some area other than their primary area of disability, access to this type of educational material must be assured.

Independent Living

In discussing access to electronic systems for independent living, we are mostly talking about the future. Although some of these systems will not become common for time to come, others will be moving into common usage before we have identified satisfactory strategies for providing access.

Automated teller machines (ATM's) are now a common fixture, and some people never visit their banks except to secure a loan. Use of automated payment systems in stories is also increasing. Many of these systems involve the use of security codes which serve as an individual's "signature"—codes which must be entered by the user, since having the number entered by the clerk or a bystander has obvious security implications.

Telecommunication for the home is now broadening from basic telephone use to the use of phones and phone lines as general information systems. In France, for example, small terminals have been installed

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which serve as phone books. This system would allow someone who was "print disabled" to look up numbers independently. However, for such a system to be accessible to, say, a blind person, the terminal must provide information in a form in which they can use it—in this case in either braille or voice.

Electronic shopping will initially by a shopping alternative; thus, disabled individuals can always have access to shopping through additional means. The increased usage of electronic shopping, however, is likely to make infrequently used items easier to find and lower in cost, eventually causing many things to be available only in this form.

Electronic public information systems are also on the increase. These systems are placed in public locations and used to provide information to customers or to the general public. Electronic directories for large buildings or shopping complexes are one example.

Finally, there are a number of new security and monitoring systems which are becoming available. These systems, which provide automatic emergency calling and even monitoring of an individual's movements to detect emergencies, are allowing elderly individuals to live independently much longer without concern for falls or other accidents which could leave them incapacitated. These systems would also be of similar benefit to individuals with a broader range of disabilities if their designs were more accessible.

As home automation increases, greater opportunities will exist for people with disabilities—particularly severe disabilities-to act and live independently in the home and community. Major challenges persist, however, particularly in the areas of research and development, assuring access to public electronic devices, and getting designs to the marketplace and to the consumer.

For more information on access to computers and other electronic devices, contact: Trace Research and Development, S-151 Waisman Center, 1500 Highland Avenue, Madison, WI 53705; (608) 262•6966.

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Accessable Workstations: An Often Neglected Necessity

A computer system that is set up for use by people with disabilities is useless if, for whatever reason, it is impossible for the user to access or work in the area where the system is located. The solutions can be as simple as making sure the computer room has a door that is wide enough to accommodate a wheelchair, keeping the level of noise low to avoid distractions to someone with a learning disability, or keeping the environment dust- and smoke-free, to the benefit of not only users with environmental illness or respiratory disabilities but also the computers. However, some solutions may require the purchase of desks and chairs with specific features and particular attention to problems of lighting to ensure accessibility. Designers of group or public workstations need to pay special attention to these factors. This column will include both general suggestions on workstation accessibility and illustrative examples of products.

Several factors need to be considered when choosing a desk that will be used by people with disabilities; this is particularly important for wheelchair users. Many standard desks have drawers, keyboard shelves, or other features that make it difficult to position a wheelchair for optimal user comfort and accessibility. It may also be hard for the wheelchair user to work at a desk where the height cannot be adjusted; this needs to receive special consideration in public work areas. Finally, the desk should be large enough to accommodate any peripherals—printers, disks, material being typed, etc.—that will be needed, and these peripherals should be easy to reach.

There are at least two tables specifically designed for use by computer users with disabilities. CompuDesk HCP is an adjustable workstation that can be cranked up and down up to twelve inches in order to accommodate a variety of wheelchairs. It will hold a microcomputer and monitor, printer and paper, external disk drives, and other materials. Turntable Desks are U-shaped tables with built-in turntables that can easily be rotated to give the user access to a number of peripheral items.

As an alternative, adjustable work benches or non-adjustable but more economical therapy tables could serve as workstations. It might also be worthwhile to consider standard office furniture with the correct dimensions. For instance, some standard workstations that appear to be reasonably accessible also have channels in the back that allow power cords and cables to be tucked out of harm's way.

It is less easy to make generalizations about computer chairs. If you have any sort of back injury or pain, it is especially important to find the right chair, but the requirements of this chair may vary from person to person. There is a Z-shaped chair designed specifically for use at computer workstations that has no back but is supposed to be good for the spine; some people swear by this furniture for computer use, others find it more comfortable to be in a chair with some back support. Springer (see "Articles," below) cites the following as guidelines for choosing workstation chairs: anatomical support (accommodating the user's body type), support of working postures (comfort should be attainable even when postures change throughout a day's use), and stability. A separate study (Grandjean, Hünting, and Nishiyama; see "Articles" below) demonstrated that the natural, and optimal, posture for working at a computer terminal is to lean backwards instead of sitting erect; therefore, they suggest that computer chairs have large, adjustable backs. For personal use, try out a few chairs at an office supply store and see what feels most comfortable—if possible, pull it up to a workstation-type desk and pretend to type for a few minutes. If you are purchasing chairs for a public workstation, follow the design principles stated above and consider selecting a few different types of chairs.

Glare is a chronic computer-related problem. Eventually, light bouncing off the screen will cause headaches for many users. In addition, glare may make it difficult or impossible to read from the monitor—especially when vision is impaired due to aging. The trick is to keep light off the screen but on the material being typed or input. Stellman and Henifin (see "Books," below) suggest the following guidelines for proper lighting of a work area:

- Lighting should be in the range of 30 to 70 foot-candles—the equivalent of a 60-watt desk lamp or a 75-watt overhead fluorescent light.

- Light fixtures should optimally be concealed and should reflect light from the upper walls. Lamps should be of the swing-arm variety that can be clamped onto a desk or other support and adjusted for optimal position. (These lamps are available from most office supply stores.)

- If the main lighting source is sunlight, monitors should be placed at right angles to windows. These windows should have adjustable blinds or curtains.

It is also possible to reduce glare by placing special screens over the computer monitor; this will be covered in a future column on monitors.

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Finally common sense goes a long way in the accessibility process. In the desire to make one office's equipment burglar-proof, the printer was bolted down in such a way that the knob used to move the paper forward was less than a hand's width from a wall. The setup is such that this was difficult for a non-disabled person to use, let alone the wheelchair-using occupant of the office. Awareness of the needs of the users and the characteristics of the area where the workstation will be located should be used together to create a work area that will be both comfortable and accessible.

REFERENCES FOR LISTED PRODUCTS AND INFORMATION SOURCES:

Books:

Stellman, Jeanne, and Henifin, Mary Sue. Office Work Can Be Dangerous to Your Health. New York: Pantheon Books, 1983, pp. 47, 180.

Articles:

Grandjean, E., Hünting, W., and Nishiyama, K. "Preferred VDT Workstation Settings, Body Posture, and Physical Impairments." Applied Ergonomics, June 1984, Vol. 15 (2), pp. 99-104.

Springer, T.J. "Sit On It—Searching for a Good Chair." Online, May 1984, Vol. 8 (3), pp. 44-45.

Desks:

Craner Cabinetry
3190 South 4140 West
West Valley City, UT 84120
(801) 966-1127

Extensions for Independence
757 Emory St. Suite 514
Imperial Beach, CA 92032
(619) 426-8054

J.A. Preston Corporation
60 Page Road
Clifton, NJ 07012
(800) 631-7277

Inmac
860 E. State Parkway
Schaumburg, IL 60195
(312) 855-8383

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HEARING THE COMPUTER SCREEN: QUESTIONS AND ANSWERS ON VOICE OUTPUT

Q: HOW CAN A PERSON USE A COMPUTER IF THEY ARE UNABLE TO READ THE SCREEN?

Frequently, people who have little or no vision but can hear reasonably well use voice output to gain access to computers. Voice output "translates" the information that usually appears in written form on a computer screen into a spoken form that is heard by the visually impaired computer user. The user is also able to hear the information that he is typing into the computer both as he is typing and after the information has been input.

Q: HOW DOES VOICE OUTPUT WORK?

Voice output usually consists of two parts: the *speech synthesizer* and a *screen reading program*. These components are usually sold separately but may be sold as a package.

The speech synthesizer is what converts the groups of letters on the screen into spoken words. It includes a dictionary which indicates correct pronunciation for most common words. Pronunciation rules are also included in the program so that as many standard language rules as possible can be recognized and reasonable pronunciations of words not included in the dictionary can be generated. For example, the rule that an "e" at the end of a word is silent but lengthens the preceding vowel is likely to be programmed into the software so that the computer correctly pronounces "mat" and "mate" as two different words.

Screen reading capability, which ranges in sophistication from program to program, allows the user to specify what she does and does not want the program to do at any given time. This can range from turning the sound on and off, to indicating whether or not words should be pronounced as words or letter by letter (the latter is useful for proofreading), to indicating which lines on the screen, by row number , should be read.

The screen reader is usually *resident software*. That is, it is loaded into the computer and then reside there while the computer is used to run other programs. Resident software may or may not be used with these other programs, depending on user needs. If the software is designed to be used with almost any software packages, it is said to provide *transparent access*. There are also software packages with built-in speech synthesis and screen reading programs; these do not require an additional resident software package.

If the speech synthesizer includes a hardware component, this component may take the form of a card that is inserted inside the computer, or it may be a box that is plugged into one of the ports on the exterior of the computer. Some boxes, and all cards, come with speakers and/or headphones that also need to be plugged in; some boxes have built-in speakers with a headphone port. The advantage of an external box-type synthesizer is that it is likely to work with several different types of computers, whereas cards are specific to only one type of computer. Before buying card-type hardware, you will also want to find out if it has already been assembled or if you will need to assemble it yourself.

Q: HOW EASY IS IT TO UNDERSTAND THE VOICE OUTPUT FROM A SPEECH SYNTHESIZER?

At first, it may be very difficult to understand what some speech synthesizers are "saying." This is not only because the voice may take some getting used to, but because speech synthesizers tend not to discriminate between what the user may and may not need. For example, the standard input prompt on an IBM PC is a capital letter followed by a colon and a "greater than" sign (e.g., "A:>"). This may translate into speech as "Capital A Colon Greater Than," and unless the user has a way of changing the input prompt to something shorter and/or more meaningful, she will have to listen to "Capital A Colon Greater Than" every time a prompt is encountered. Because the synthesis software cannot tell the difference between a colon that is part of a prompt and a colon that is part of the text of, say, a word processing document, it will always read the colon aloud. However, with some practice in listening and an appreciation for what the computer conventions are, speech synthesizers usually become sufficient for the user's needs.

Q: WHAT CRITERIA SHOULD I USE WHEN SHOPPING FOR VOICE OUTPUT?

Some programs are written specifically to be used with voice output, and may even contain speech synthesis and/or a screen reading program. These programs can be as powerful as standard programs; they may simply lack graphics or complicated screen layouts.

The criterion for choosing among standard programs should be simplicity. Since most synthesizers read the screen line by line, it will be beneficial to look for a program that is laid out line by line instead of one that scatters information across the screen. In addition, the same commands may be used by the screen reading software and the standard program; the screen reading command will supercede that of the standard program. If you have a choice, look for standard programs that have either non-conflicting or redefinable commands.

However, in many cases, the user is acquiring voice output so that he may work with a software package that has already been selected by an office, a university, etc. Since these packages were likely not to have been chosen with voice output compatibility in mind, the user will need to seek out voice output that has been designed to work with the established software (for example, there are screen reading programs that are specifically designed to work with spreadsheets) or software that provides transparent access.

There is not yet a way of interpreting graphics into speech, so graphics-based operating systems, such as those that use pictures to represent files, are not fully accessible to people who do not see the screen. Research is currently being conducted to explore ways of conveying the information in these operating systems to people with visual impairments.

Q: HOW DOES VOICE OUTPUT HANDLE VARIOUS LANGUAGES?

Voice output software can only handle languages whose rules have been programmed into it. If French text is used with an English speech synthesizer, the text will be pronounced according to the rules of English pronunciation. It is not yet even possible to program in all the rules for a single language; there are no commercially available speech synthesizers for microcomputers that have rules for pronouncing "wind" according to context ("wind" a ball of yarn or the gusting "wind"). Programs for some languages are currently available; others are still being developed.

Q: BESIDES PEOPLE WITH VISUAL

•see Voice on page 23

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IMPAIRMENTS, WHO ELSE WOULD BE LIKELY TO BENEFIT FROM VOICE OUTPUT?

People with learning disabilities, such as dyslexia, may find it useful to hear text at the same time that they see it. It is also possible for non-speaking people to use voice output as a communication system.

MANUFACTURERS

American Printing House for the Blind
Dept. O-0686
P.O. Box 6085
Louisville, KY 40206
(502) 895-2405

Artic Technologies
55 Park Street Suite 2
Troy, MI 48083
(313) 588-7370

Computer Conversations
6297 Worthington Road SW
Alexandria, OH 43001
(614) 924-2885

Raised Dot Computing
408 S. Baldwin
Madison, WI 53703
(608) 257-9595

Telesensory Systems, Inc.
455 North Bernardo Ave.
P.O. Box 7455
Mountain View, CA 94039
(415) 960-0920

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A Little Light Reading

People have a lot of different ways of finding out about assistive technology. They may hear about it from a friend; they may hear about it from a doctor or a therapist; they may read an article in the newspaper or see an advertisement.

But if you're trying to decide about products or to help someone else decide you'll find it useful to read up on assistive technology, and to do it on a regular basis. You'll find out about options you didn't know existed; you'll hear about others' experiences with something you are using or considering using; you may learn about organizations of consumers or professionals that can help you. There are a lot of publications devoted to technology for people with disabilities, from glossy magazines to homespun newsletters. It's worth pursuing these publications, since coverage in the "mainstream media" is scanty and often more interested in the drama than the details. If you're trying to find solutions, details are what you want: the more specific, the better.

The best way to keep abreast of what's happening is to find one, two or a few publications that you can read regularly. In choosing which ones you want to devote your reading time to, try to get a hold of some back issues. Look at the content. Do most of the articles deal with the kinds of assistive devices you're interested in? Can you understand the concepts and terminology or are they too technical? And most importantly, do the articles tell you things that you don't already know?

Listed below are some magazines and newsletters you might want to check out. We've provided an address for the publisher, in case a local library doesn't carry it. (This is particularly likely to be true of the newsletters. Many are goldmines of information despite their low budgets and small circulations.) The publications listed are generally non-technical in nature, but at the same time provide concrete and detailed information. Be sure to note Closing the Gap if you're interested in computers and communication.

Micro Scope
Handicapped Children's
Computer Cooperative Project
7938 Chestnut
Kansas City, MO 64132
Features product news, programming hints and resource lists on the topic of using computers with disabled youngsters.

COPH Bulletin
COPH-2
2030 Irving Park Road
Chicago, IL 60618
This newsletter features "Link-and-Go," a section dealing with computers and disability. News includes resource listings, product announcements, and general interest articles.

ConnSENSE Bulletin
University of Connecticut
Box U-64
49 Glenbrook Road
Storrs, CT 06268
Newsletter dealing with use of computers in special education. Contains reviews of software.

Technology Update
Sensory Aids Foundation
399 Sherman Ave., Suite 12
Palo Alto, CA 94306
News on technological aids for people who are blind or visually impaired. Includes product reviews and news about new developments.

Closing the Gap
P.O. Box 68
Henderson, MN 56044
This newsletter deals with all aspects of computers and disability. Also deals with augmentative communication. Annual product index.

Computer-Disability News
National Easter Seal Society
20223 W. Ogden Ave.
Chicago, IL 60612
Quarterly newsletter dealing with products, services and public policy issues. Frequently provides resource lists.

Communicating Together
Easter Seal Communication
Institute
24 Ferand Drive M3C 3N2
Contains news on augmentative communication, tips for using and developing communication systems, and articles by technology users.

Assistive Device News
Pennsylvania Assistive Device
Center
150 South Progress Ave.
Harrisburg, PA 17109
Contains news about products, plus articles on therapy techniques. Aimed primarily at speech pathologists, occupational therapists and others working with physically disabled school-age children.

Communication Outlook
405 Computer Center
Michigan State University
East Lansing, MI 48824
Contains product news and practical information for users of augmentative communication systems, and those who work with them.

Window on Technology
Program Technology Branch
Ministry of Community and Social
Services
16 Breadalbane St.
Toronto, ON, Canada M4Y 1C3
Offers news about research and development in Canada and the U.S. Also contains articles by and about users of technology.

Vendor Newsletters

There are also adaptive equipment vendors who publish newsletters. Although these are naturally oriented toward one company's products, they can often provide helpful hints and updates on new developments. They may be free, particularly to customers.

As with buying a car or a washing machine, the more you know about assistive technology, the better the decisions you will be able to make. If you take an interest in the topic beyond the immediate problem you are trying to solve, you'll find in the long run that it pays off. You will discover options you didn't expect and ideas you might never have thought of. You may become an information source that others rely on.

Technically Speaking

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A vital part of the field of computer use in rehabilitation technology are annual conferences where new products are presented and ideas are shared. Two of these conferences are Closing the Gap (CTG), held in October in Minneapolis, and the Conference on Computer Technology/Special Education/Rehabilitation (CSUN), which will next be held in April, 1990 in Los Angeles. Since registration for both of these conferences is open to anyone with an interest in rehabilitation technology, since both make an admirable effort to use accessible facilities, and since both charge only a nominal fee for entrance to just the product exhibits, they are excellent opportunities for consumers, and parents and friends of consumers, to meet and talk to vendors, developers, clinicians, and a variety of other professionals.

CTG was started in 1983 by Budd and Dolores Hagen, who also publish a newsletter called *Closing the Gap* that contains product reviews and articles on hardware and software of interest to people with disabilities. This year, the conference featured 64 exhibit booths and ran from October 20th through the 22nd, with pre-conference workshops on October 18 and 19. CSUN has been sponsored since 1985 by the Disabled Student Services Office at California State University at Northridge (hence the acronym), and ran this year from November 2nd through the 4th, with 37 exhibit booths. (This year, CSUN was held for the last time at the university itself; future conferences will be held at a hotel next to the Los Angeles airport so that more exhibit booths can be accommodated.)

Exhibit booths tend to be product-oriented. Products on display at one or both conferences include: software designed to be used in special education classes, speech synthesizers to allow people with visual impairments to hear information read from the computer screen, boards that can be programmed to speak different phrases when different areas of their surfaces are touched, Braille printers, devices allowing input to the computer to be accomplished by methods other than typing on a keyboard, and telecommunication devices (TDDs) that allow people with hearing impairments to send and receive messages over telephone lines. In most cases, it is possible to spend time actually using the product, exploring its strengths and weaknesses. In addition, some booths are run by , and feature information on, local rehabilitation programs, advocacy groups, and research centers. While the majority of booths (and attenders) are based in the United States, Canada is well represented, and some people come in from Europe or Australia.

For the full registration fee (under $200 in both cases, with some funding available for waiving attendance fees for persons with disabilities), the conference participant can not only look at the booths but also attend presentations on state-of-the-art products and research. Typical presentation titles at CSUN this year included: "Deafness, Cognition, and Computers," "Versatile Software for Special Education and Early Childhood Development," "Effective Computer Access for Single-Handed Individuals," and "Effective Software Evaluation." CTG featured presentations on, among other topics, "New Frontiers in Braille Production and Use," "How To Set Up A Computer Access Lab," "Technology, Literacy, and Special Education," and "What's Out There in Computer Software." Other topics at one or both conferences included funding, legislation, and reports on other conferences. CTG also features computer labs which, when not being used for product demonstrations, are set up to allow people to experiment with computer hardware and software that may not be familiar to them.

The most valuable part of these conferences, however, may be the opportunity to stand around in the exhibit halls, after the presentations, or at one of the receptions and talk to other participants. Vendors in particular are eager to know what features will make their products attractive to as wide a cross-section of consumers as possible, and tend to take suggestions quite seriously.

Finally, if you are unable to attend these conferences, it is possible to purchase Conference Proceedings, which contain articles summarizing the presentation topics, from CTG and CSUN. These proceedings can be purchased for previous years' conferences as well.

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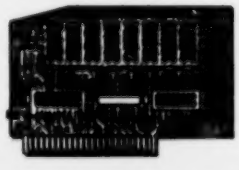

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